

# NASA TECH BRIEF

## Goddard Space Flight Center



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### Dual-Frequency Feed-Horn Antenna

#### The problem:

To design and fabricate a single antenna that receives and transmits simultaneously at the  $K_u$  (15.2 GHz) and  $K_a$  (31.65 GHz) bands.

#### The solution:

A dual-frequency feed-horn antenna (Fig. 1 and Fig. 2) with a novel two-port diplexer that separates

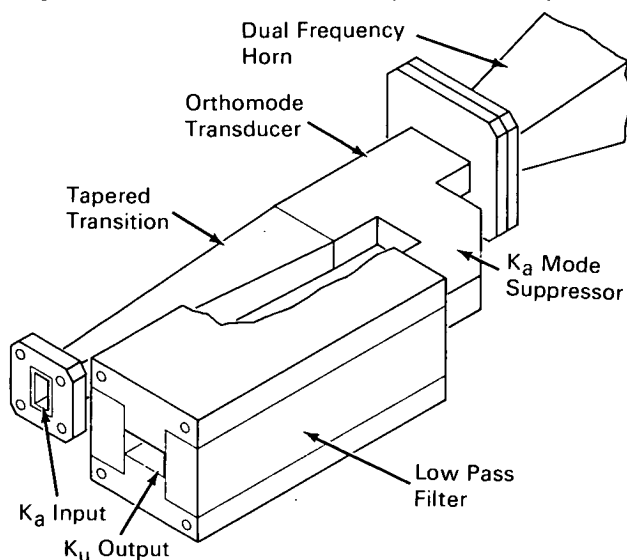


Figure 1. Diplexer Network

the high power  $K_a$  transmitted signal from the low power  $K_u$  received signal.

#### How it's done:

The two-port feed network consists of a T-network at the  $K_u$  waveguide followed by an on-axis taper to the  $K_a$  waveguide. Attached to the side arm of the T-network is a low-pass filter and mode-suppressor terminal combination which isolates the  $K_u$

terminal from the high level signal. The horn is fed with the electric field polarized perpendicular to the fins at  $K_u$  band and parallel to the fins at  $K_a$  band. The fact that the system utilizes orthogonal polarization permits this type of loaded aperture to be employed. However, in order to provide dual-frequency feed-horn operation from a single aperture, it is necessary to compensate for the change in beamwidth as a function of frequency. This problem is solved by placing pins in the horn mouth and aligning them with the E-field at  $K_a$  band, thus reducing the effective aperture. The two-port network simultaneously feeds the dual-frequency horn and excites the antenna, with only a minimal loss in power. Isolation between the transmit port and the low level receive port ranges from 60 to 80 dB.

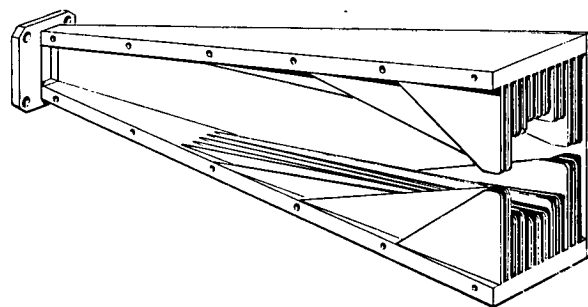


Figure 2. Dual Frequency Horn (Side Panel Removed)

#### Note:

Requests for further information may be directed to:

Technology Utilization Officer  
Goddard Space Flight Center  
Code 207.1  
Greenbelt, Maryland 20771  
Reference: B71-10056

(continued overleaf)

**Patent status:**

No patent action is contemplated by NASA.

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